These are probably filled with mistakes so if you think something's wrong let me know

Old Midterm 4)

$$\underbrace{\boxed{1}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{5}\ \boxed{6}}$$

$$\underbrace{3\ \boxed{0}\ \boxed{2}\ \boxed{4}\ \boxed{6}}_{48}$$

$$EV = \text{avg} \cdot \#\text{draws}$$

$$\text{avg} = \frac{0+0+0+2+4+6}{6}$$

$$= 2$$

$$EV = 48 \cdot 2 = 96$$

$$SE = \sqrt{\#\text{draws}} \cdot sd$$

$$\sqrt{\frac{3(0-2)^2+(2-2)^2+(1-2)^2+(6-2)^2}{6}}$$

$= sd$

$SE = \sqrt{98} \cdot sd$

$$SU = \frac{\text{value} - EV}{SE}$$

$$= \frac{104-96}{SE}$$

pnorm(x) gives probality less than x

$\Rightarrow$ 1−pnorm(x) gives more than x

$1 - \text{pnorm}(SU)$.

Old midterm #5).

Prob	dice shows	payout
$\frac{1}{3}$	1 or 2	-1
$\frac{1}{3}$	5 or 6	1
$\frac{1}{3}$	3 or 4	0

$$\underbrace{\boxed{-1}\ \ \boxed{1}\ \ \boxed{0}}_{400}$$

$$EV = 400 \cdot \text{avg}$$
$$= 0$$

$$SE = \sqrt{400} \cdot sd$$

$$sd = \sqrt{\frac{(-1-0)^2 + (1-0)^2 + (0)^2}{3}}$$

$$= \frac{\sqrt{2}}{\sqrt{3}}$$

$$\Rightarrow SE = \sqrt{400} \cdot \frac{\sqrt{2}}{\sqrt{3}}$$

b) Check for normal approx.

1) at least 25 draws ✓

2) $EV \pm 2 \cdot SE$ is a possible value. ✓

$SE \simeq 16$

$\Rightarrow -32$ to 32

$$SU = \frac{10 - EV}{SE}$$

$EV = 0$

$SE \approx 16.33$

$1 - \text{pnorm}(SU)$.

c) Chance that I win more than 120 of the 400 games.

$$\underbrace{2\ \boxed{0}\ \boxed{1}}_{400}$$

$\text{avg} = \frac{1}{3}$

$$EV = \frac{400}{3}$$

$$SE = \sqrt{400}\sqrt{\frac{\left(0-\frac{1}{3}\right)^2 + \left(0-\frac{1}{3}\right)^2 + \left(\frac{2}{3}\right)^2}{3}}$$

$$SU = \frac{120 - EV}{SE}$$

$$1 - pnorm(SU).$$

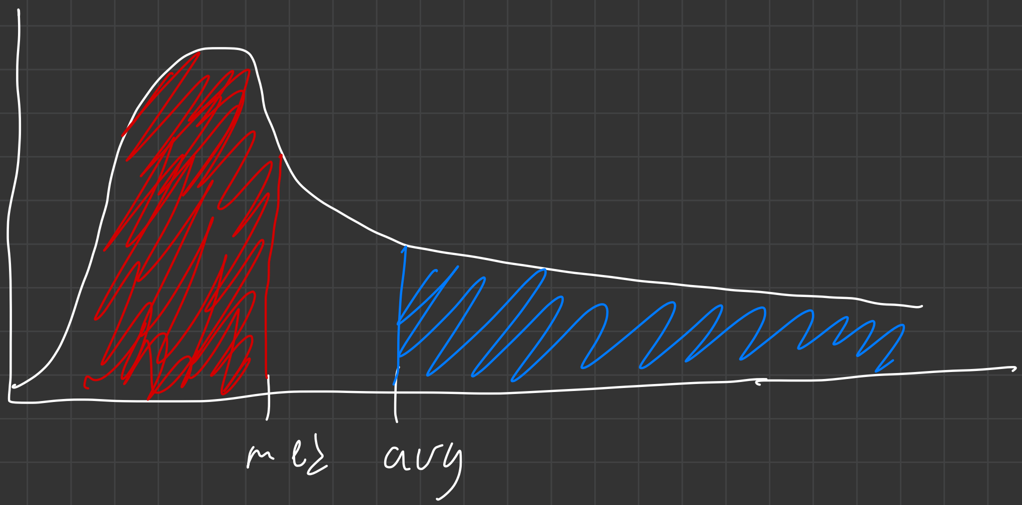
Ch 5 : Rev 10.

Avg income 32 000

SD 26 000

want the percentage of incomes in range 32-150 th.

Is it closer to 40, 50 or 60.



$\Rightarrow$ 40%

Old midterm 7:

1. Normal, Symmetric

$\Rightarrow$ mean = median.

$$\text{qnorm}(0.84) = \frac{67 - \text{avg}}{sd}$$

$$\text{qnorm}(0.07) = \frac{61 - \text{avg}}{sd}$$

$\boxed{1}\ \boxed{1}\ \boxed{3}$

Q4 Quiz 5

$1, 1 \to 1$

$3, 3 \to 9$

$1, 3 \to -4$

$$P\left(\begin{matrix} 1,3 \\ \text{or} \\ 3,1 \end{matrix}\right) \begin{matrix} \to \frac{2}{3} \cdot \frac{1}{3} \\ + \\ \to \frac{1}{3} \cdot \frac{2}{3} \end{matrix}$$

k	$P(X=k)$
1	$\frac{2}{3} \cdot \frac{2}{3}$
9	$\frac{1}{3} \cdot \frac{1}{3}$
-4	$2 \cdot \frac{2}{3} \cdot \frac{1}{3}$

$$E(X) = \sum_{k} k \cdot P(X=k)$$

$$= 1 \cdot P(X=1) + 9 \cdot P(X=9) + (-4) \cdot P(X=-4)$$

$$= \frac{4}{9} + 9 \cdot \frac{1}{9} - 4 \cdot \frac{4}{9}$$

$$= -\frac{12}{9} + 1 = \frac{-3}{9} = \frac{-1}{3}$$

$$SE(X) = \sqrt{E\left(\left(X - E(X)\right)^2\right)}$$

$$= \sqrt{\sum_{k} \left(k - E(X)\right)^2 P(X=k)}$$

$$= \sqrt{\left(1 - \left(-\frac{1}{3}\right)\right)^2 \cdot \frac{4}{9} + \left(9 - \left(-\frac{1}{3}\right)\right)^2 \cdot \frac{1}{9} + \left(-4 - \left(-\frac{1}{3}\right)\right)^2 \cdot \frac{4}{9}}$$

old midterm Q2

a) P(exactly 2 fours)

$$= \binom{4}{2}\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^2$$

b) 1 − P(all rolls are 2 or more).

$$1 - \binom{4}{4}\left(\frac{5}{6}\right)^4$$

c) P(exactly 2 ones or exactly 2 sixes) a)

$$= \boxed{P(\text{exactly 2 ones}) + P(\text{exactly 2 sixes})}$$

$$- \underbrace{P(\text{exactly 2 ones and exactly 2 sixes})}$$

NOT mutually exclusive

$$\underline{1}\quad \underline{1}\quad \underline{6}\quad \underline{6}$$

$$\left(\frac{1}{6}\cdot\frac{1}{6}\right)\cdot\left(\frac{1}{6}\cdot\frac{1}{6}\right)$$

$$\left(\frac{1}{6}\right)^2\cdot\left(\frac{1}{6}\right)^2$$

# of ways to choose 2 spots out of 4 spaces is $\binom{4}{2}$ so answer is

$$\binom{4}{2}\left(\frac{1}{6}\right)^2\left(\frac{1}{6}\right)^2$$

Section 112

$$\boxed{37\ \boxed{1}\quad \boxed{2}\quad \boxed{3}\quad \boxed{30}}$$

30

2018 Q4

a) In 30 draws.

$$P(\text{sum draws} \leq 30).$$

$$\text{avg} = \frac{37 + 2 + 3 + 30}{40}.$$

$$= 2$$

$$sd = \sqrt{\frac{37 \cdot (1-2)^2 + 0^2 + (3-2)^2 + (30-2)^2}{40}}$$

$$= \sqrt{\frac{37 + 1 + 36^2}{40}}$$

$$= 5.9$$

$$EV = \#\text{draws} \cdot 2 = 60$$

$$SE = \sqrt{\#\text{draws}} \cdot SD = \sqrt{30} \cdot 5.9$$
$$\approx 32.3$$

$$EV - 2SE < 0.$$

$\Rightarrow$ normal approx bad

$$P(\text{sum } 30 \text{ draws} \le 30)$$

$= P($ exactly 30 in 30 draws$)$

$= P($drawing 30 $\boxed{1}$'s$)$

out of 30 draws.

$$= \left(\frac{37}{40}\right)^{30}$$

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sd in R uses

$$\sqrt{\frac{1}{n-1} \sum (x - avg)^2}$$

we use

$$\sqrt{\frac{1}{n} \sum (x - avg)^2}$$

z is a vector in $\mathbb{R}$

$$\text{ours}d = sd(z) \cdot \frac{\text{sqrt}(n-1)}{\text{sqrt}(n)}$$

n = length of vector z.

P(at least heart or at least one spade)

= P(at least 1 heart) +

P(at least 1 spade)

− P(at least 1 heart and at least 1 spade).

$P\left(\begin{array}{c}\text{at least}\\ \text{1 heart}\end{array}\right) = P(\text{hs or sh or hh})$

$$= 2\frac{13}{52}\cdot\frac{13}{51} + \frac{13}{52}\cdot\frac{12}{51}$$

$$= P(\text{at least 1 spade})$$

P(at least 1 heart and at least 1 spade)

$$= P(\text{hs or sh})$$

$$= 2\frac{13}{52}\cdot\frac{13}{51}$$

Quiz 4 choose question

From a group of 7 men and 6 women five people are to be selected to form a committee with at least 3 men.

Choose (binomial coefficient)

3 men, 4 men or 5 men

$$\binom{7}{3} \cdot \binom{6}{2} + \binom{7}{4}\binom{6}{1}$$

$$+ \binom{7}{5}$$

$$\text{Choose}(7,3) = \binom{7}{3}$$

$$= \frac{7!}{(7-3)!\,3!}$$

Ch5 A2 (Section 12)

13, 9, 11, 7, 10

$$SU = \frac{\text{Value} - \text{avg} \leftarrow EV}{\text{Sd} \leftarrow SE}$$

$$\frac{13+9+11+7+10}{5} = 10.$$

$$sd = \sqrt{\frac{(13-10)^2+(9-10)^2+(11-10)^2+(7-10)^2}{5}}$$

$$= \sqrt{\frac{9+1+1+9}{5}}$$

$$= \sqrt{\frac{20}{5}} = 2.$$

values - avg $= (3, -1, 1, -3, 0)$

$$\frac{\text{values-avg}}{SD} = \left(\frac{3}{2}, -\frac{1}{2}, \frac{1}{2}, -\frac{3}{2}, 0\right)$$

Gambler Roulette

$P(X=R)$	R
$\frac{2}{38}$	17
$\frac{36}{38}$	-1

↙ 1 draw.

$\underbrace{2\ \boxed{17}\ \ 36\ \boxed{-1}}$ → 25

$\underbrace{1\ \boxed{17}\ \ 18\ \boxed{-1}}$ → 25-

If S_n = sum of n ind. random X. variables

$$E(S_n) = n\,E(X)$$

$$SE(S_n) = \sqrt{n} \cdot SE(X)$$

EV = #draws · avg

SE = $\sqrt{\text{\#draws}}$ · SD.